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Rita S. McAllister

Naval Aerospace Medical Research Laboratory  
Pensacola, Florida

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All numbered reports have been approved for public release; distribution is unlimited. Requests for reprints of open literature documents should be addressed to the author.

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14. KEY WORDS	LINK A		LINK B		LINK C	
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Aeronautical adaptability Aircraft accident analysis Pilot performance prediction Student pilot errors N7O task analysis Signal detection theory Individual Decisional differences Disorientation/vertigo Orientation Error Accidents Microwaves Electromagnetic fields Operant behavior Biomedical effects of ELF Anthropometry Impact acceleration Anatomical mass distribution Vertebral column Noise exposure effect High frequency hearing Space medicine Aviation medicine Weightless: ees Angular acceleration Oculogyral illusion Motion sickness Vestibular function Galactic radiation Personnel selection Zoonotic diseases Aviation personnel performance prediction Cardiac arrhythmias Mid-systolic click Gz maneuvers State and trait anxiety Spinal injury Noise monitors Otolith function Artificial gravity Speech communications Nystagmography Electroencephalography Bibliographies						

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(PAGE 2)

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**FORWARD**

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RITA S. McALLISTER

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Navy Department

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\*Denotes studies performed jointly with and supported by the United States Army Aeromedical Research Laboratory, Fort Rucker, Alabama.

Work Unit

MF51.524.002-5012DX5X.6  
NAMRL-1184  
(AD 764 868)

Human Factors Approach to Aircraft 6/18/73  
Accident Analysis

Richard H. Shannon and Wayne L. Waag

**Abstract:**

Naval Accident reports involving the P-3 and F-4 aircraft were examined over seven and five-year periods, respectively. The critical incident technique was used to catalogue, describe and analyze operational flight crew errors in both aircraft. An in-depth study was performed in order to identify those problems which were common as well as specific to both aircraft. The P-3 and F-4 aircraft were selected because of their completely different fleet missions and handling characteristics.

From the F-4 accident reports, 437 human errors were isolated while the P-3 reports contained 345 errors. Twenty-eight major error categories emerged from the analysis of these errors. The accident reports were further analyzed for the errors which both aircraft had in common. Twenty common error groups were found to occur in the P-3 and the F-4, representing 22.9% and 18.8% of the total errors, respectively. The Flight segment of Takeoff/Landing, and the error type of Procedures, shared the most commonality across the two aircraft.

The results of this investigation suggest that although common errors can be isolated across highly dissimilar aircraft with highly different flight missions, they comprise a relatively small percentage of total errors. By far, the majority of errors concerned characteristics unique to the particular aircraft in question. Implications in the remedial areas of crew coordination, training, discipline and design are discussed.

MF51.52 .002-5013DX5X.8  
NAMRL-1186  
(AD 764 866)

The Prediction of Pilot Performance in 7/9/73  
the F-4 Aircraft

Richard H. Shannon and Wayne L. Waag

**Abstract:**

In previous investigations, attempts were made to isolate the most critical skills and

procedures within each stage of replacement air group (RAG) training in the F-4 aircraft. For each of the stages analyzed, a small set of items were selected on the basis that they could discriminate among replacement pilots according to their final RAG grade. On the basis of these isolated skills, two fleet evaluation questionnaires were developed to be used by operational F-4 squadron commanders. In addition to ratings on these two rating forms, squadron commanders were asked to report "critical incidents". These included such occurrences as accidents, incidents, and "wings-pulled". Data obtained from these two forms were used as the criterion measures in this investigation.

Selected test scores and flight grades from undergraduate pilot training were used as potential predictors. These were related to the criteria in a series of correlational and regression analyses. A number of significant relationships were obtained among the performance measures. Such results indicated the method used in developing the rating form to be a feasible one. Implications are discussed in terms of potential use for actual assignment of aviators to RAG training in the F-4 aircraft.

MFJ1.524.002-5013DX5X.9  
NAMRL-1187  
(AD 764 867)

System Level Commonality Analysis of the 7/10/73  
S-3A/P-3C TACCO Position

William F. Clisham, Jr.

**Abstract:**

Realistic undergraduate and fleet training requirements have to be established for NFOs who are to man the S-3, one of the Navy's newest production aircraft. The purpose of the present study was to document a tactical coordinators (TACCO) potential operational functions on an S-3, and to identify what relationships the resultant duties and tasks have with a TACCO's operational functions on a P-3C.

Approximately 64% of a TACCO's tasks are relatively identical for S-3 and P-3C Weapon Systems at the functional level. The distribution of these tasks across training areas is concentrated most in the

Tactics and Sensor Management areas. Approximately 21% of a TACCO's task are relatively similar for the S-3 and P-3C Weapon Systems. Of these, almost 100% have become automated function related tasks in the S-3.

The author wishes to acknowledge his indebtedness to E.L. Patterson and P.K. Dittman of Lockheed-California Company for their technical review of S-3A material. The assistance provided by training personnel from Patrol Squadron THIRTY and Patrol Squadron THIRTY ONE in preparing P-3C material is also gratefully acknowledged.

MF51.524.002-5013DX5X.10  
NAMRL-1189  
(AD 767 377)

Isolation of Recurring Student Pilot Errors During Primary Flight Training.  
1. Spin Maneuver

8/15/73

Richard H. Shannon, Wayne L. Waag and Gerald M. Long

**Abstract:**

The present investigation attempted to (1) develop a conceptual model for investigating student naval aviator (SNA) performance in Primary flight training; (2) isolate, with the use of the model, those behaviors within the Spin Maneuver which are judged to be recurring student pilot errors; (3) assess the criticality of these errors as they relate to the grades a student receives; and (4) provide behavioral definitions of the global skills, Basic Airwork, Headwork, and Procedures.

A procedural type of task analysis was performed on the Spin Maneuver. The necessary responses to each display and control both within and outside the aircraft were specified on a sequential continuum. Within each of these sequential components, a highly elemental approach (i.e., emphasis on the simultaneous individual responses to each display and control at each point in time) was taken so that it was possible to isolate the required simultaneous response configuration at any given

point throughout the maneuver. An objectively structured questionnaire was developed using these individual task elements as the basic item pool, and administered to a sample of 97 flight instructors in Primary flight training.

The results of this investigation indicated that the recurring student errors within the Spin Maneuver could be isolated using this type of approach. Further, the definitions for the terms Basic Airwork, Headwork and Procedures and what constitutes a "critical" error were set forth.

MF51.524.004-2006DX5L.2  
NAMRL-1194  
(AD 771-375)

Naval Flight Officer Function Analysis. 11/2/73  
Final Report Commonality of Operational Functions

Richard E. Doll

**Abstract:**

During 1972, the Naval Aerospace Medical Research Laboratory (NAMRL) conducted a series of investigations analyzing the operational functions of the NFO. A major part of that series involved the determination of the tasks performed by the NFO in various aircraft. Specifically, the NFO positions examined were: P-3C NAVCOM, P-3C TACCO, RA-5C RAN, A-6 B/N, EA-6 ECMO, E-2 CICO, and F-4 RIO. For each of the NFO positions a Function Description Inventory (FDI) was developed. The purpose of this part of the study was to develop a compendium of functions encompassing all the duties and tasks contained in the various FDIs, to have this compendium reviewed by NFO personnel of all the respective operational squadrons and to do a cross-comparison based on these data to provide information as to which NFO communities perform the tasks and to what extent.

This report provided a useful compendium of functions and tasks required to be performed by the operational NFO community.

This publication, along with the eight volumes of the NFO Function Analysis, should be useful to personnel responsible for evaluating, revising, or developing NFO training programs.

MF51.524.004-5002BX5G.8  
NAMRL-1185  
(AD 765 732)

Decisional Differences Among Individuals: A Signal Detection Theory Approach 6/18/73

Gerald M. Long and Jack B. Shelnutt

**Abstract:**

The applicability of current theory and measures of risk-taking (R-T) to the understanding and selection of military aviators was investigated. The project consisted of three inter-related sections: (1) an extensive review and critique of the literature in R-T, (2) the development of an alternate measure emphasizing the decisional aspects of R-T, and (3) preliminary findings of a brief study employing the proposed Signal Detection Theory measure.

On the basis of the R-T literature review, a number of serious weaknesses and difficulties in existing R-T measures were enumerated. Because of these problems, an attempt was made to determine an alternative measure which stressed the decisional aspects of the R-T situation. This involved the application of the Signal Detection Theory framework to a psychophysical task of changing signal probabilities. The validity of this approach for determining decisional differences among individuals was investigated in an auditory detection task of very limited length. The results in general were favorable to this alternative approach to measuring meaningful individual differences along a statistical decision dimension.

MF51.524.005-5016BX1J.13  
USAARL 74-3  
NAMRL-1188  
(AD 767 028)

Orientation-Error Accidents in      8/10/73  
Regular Army Aircraft During  
Fiscal Year 1970: Relative  
Incidence and Cost

Jorma I. Niven, W. Carroll Hixson,  
and Emil Spezia

**Abstract:**

This report is the fourth in a longitudinal series of reports dealing with the pilot disorientation/vertigo accident problem in Army fixed wing and rotary wing flight operations. Incidence and cost data presented for fiscal year 1970 include a total of 81 major and minor orientation-error accidents (25 of which were fatal), resulting in 80 fatalities, 104 non-fatal injuries, and an over-all aircraft damage cost of \$19,355,689. The contribution of rotary wing accidents to this total was 75 accidents (24 of which were fatal), resulting in 79 fatalities, 98 nonfatal injuries, and an over-all aircraft damage cost of \$17,060,490.

MF51.524.005-5016BX1J.14  
USAARL 74-5  
NAMRL-1192  
(AD 768 307)

Orientation-Error Accidents in      9/14/73  
Regular Army Uh-1 Aircraft During  
Fiscal Year 1970: Relative  
Incidence and Cost

Jorma I. Niven, W. Carroll Hixson,  
and Emil Spezia

**Abstract:**

This report is the fourth in a longitudinal series of reports dealing with the magnitude of the pilot disorientation/vertigo accident problem in Regular Army UH-1 helicopter operations. Incidence and cost data presented for fiscal year 1970 include a total of 43 major and minor orientation-error accidents (17 of which were fatal), resulting in 66 fatalities, 67 nonfatal injuries, and a total UH-1 aircraft damage cost of \$7,706,191.

MF51.524.015-0012BE7X.1  
NAMEL-1183  
(AD 784 533)

Microwave Reflection, Diffraction 6/11/73  
and Transmission By Man-A Pilot  
Study

Vernon R. Reno and Dietrich E. Beischer

**Abstract:**

Field patterns were measured for the first time in proximity to human subjects exposed to low intensity cw microwave fields at 1 GHz. Pronounced standing waves were observed on the illuminated side and distinct shadows produced on the opposite side of the subjects. The fine structure of the interference patterns was related to the polarization of the incident wave.

The field perturbations described have implications in evaluation of the radiation dose experienced by one man in proximity to another, in the location of personal dosimeters, and in the estimation of energy absorbed by man from a microwave field.

MF51.524.015-0012BE7X.2  
NAMEL-1199  
(AD 780 226)

Microwave Reflection, Diffraction 2/7/74  
And Transmission Studies of Man

Vernor R. Reno

**Abstract:**

Basic, detailed information is not available concerning the changes in energy distribution in a microwave field caused by the introduction of man or animals. For safety monitoring, power measurements in proximity to man may be subject to gross errors in interpretation if these changes are not taken into consideration. Similar errors could result if the field perturbations caused by other nearby personnel or reflecting objects are not recognized.

A systematic, detailed description of the spatial energy distribution in microwave fields in proximity to man is provided for the first time. Graphic information is provided to demonstrate

the effects on the energy distribution of different radiation parameters such as frequency and polarization and of the ratio of subject size to wavelength. The field patterns obtained with man are compared to theoretical studies of simpler objects available in the literature.

The information obtained in the present studies is immediately applicable to hazard evaluations and to the design of bioeffect investigations. The most significant benefit of the approach is in the potential for development of a new, noninvasive method for estimating the energy absorbed by man or animals from an incident microwave field.

MP51.524.015-0013BEOX.4  
NAMRL-1177  
(AD 764 531)

Technique For Reducing The Ambient 4/5/73  
Electric Field Generated By Inductive  
Voltages In Low Frequency Magnetic  
Field Generators

James D. Grissett

**Abstract:**

U. S. Navy interest in the physiological effects of nonionizing radiation in the extremely low-frequency (ELF) range has led to the construction of research facilities in which various life forms can be exposed and their physiological responses to these fields monitored. The magnetic component is generated by a coil system in resonance with a capacitor bank. The inductive voltage drop across the system is sufficient to generate a high electric field between the coil sections. This electric field is undesirable because it does not allow effects of the magnetic field to be separated from effects of the electric field.

The undesirable electric field component can be minimized by breaking each section at its center. These subsections can then be connected with the capacitors in such a way that the electric field generated

by each coil segment is canceled by the electric field generated by another segment of the same coil. Several different arrangements will accomplish the desired cancellation. The pros and cons of each arrangement are a function of the required number of capacitors and the voltage levels on the interconnecting cables. Very large coils producing high magnetic fields can be constructed in this manner.

MF51.524.015-0013BEOX.5  
NAMEL-1180  
(AD 770 140)

Exposure Of Man To Magnetic Fields 7/30/73  
Alternating At Extremely Low  
Frequency

Dietrich E. Beischer, James D. Grisett  
and Robert E. Mitchell

**Abstract:**

Ten subjects were confined for periods up to 7 days and during this time were exposed to a low-intensity magnetic field ( $10^{-4}$  Wb/m<sup>2</sup> at 45 Hz) for periods up to 24 hours. Five subjects were confined but were not exposed. A large battery of physiological and psychophysiological tests were given throughout the confinement period. No effects were seen that could be definitely linked with the magnetic field. The only changes that could be correlated with the time course of exposure to the ELF magnetic field were in serum triglycerides of blood samples drawn 14 hours after the evening meal. In 9 of the 10 exposed subjects, serum triglycerides reached a maximum value of 24 to 48 hours after the ELF field exposure. Similar trends were not seen in any of the 5 control subjects. For the corresponding period chylomicrons were negligible for all subjects while cholesterol levels were stable and within the normal range; therefore, the serum triglycerides were in the form of very low density lipoproteins. The number of subjects is too small, however, to exclude statistically other factors such as psychophysiological reactions to forced changes in personal living habits, modified activity, restricted diet, and

confinement. A final conclusion must await further experiments and the establishment of a relationship between field strength and physiological effects, as well as establishment of a threshold for the effects.

MF51.524.015-0014BX7X.2  
NAMRL-1179  
(AD 764 532)

Operant Behavior of Rhesus Monkeys 3/15/73  
in the Presence of Extremely Low  
Frequency-Low Intensity Magnetic  
and Electric Fields: Experiment 2

John de Lorge

**Abstract:**

Consonant with the U.S. Navy's exploration of the biological effects of extremely low frequency electromagnetic radiation, the present studies exposed two rhesus monkeys to 10-gauss 45-Hz and 10-Hz fields. Low intensity electric fields occurred simultaneously. No effects of the 45-Hz fields on immediate memory, operant responding, reaction time, or activity were observed. Statistically significant effects were produced by 10-Hz fields, but not in both animals nor in a replication of the experiment. The study failed to provide unequivocal evidence that ELF magnetic and electrical fields affect behavior, although weak support for effects of 10-Hz fields on general motor activity was given.

MF51.524.015-0014BX7X.3  
NAMRL-1196  
(AD 774 106)

Operant Behavior of Rhesus Monkeys 11/5/73  
in the Presence of Extremely Low  
Frequency-Low Intensity Magnetic  
and Electric Fields: Experiment 3

John de Lorge

**Abstract:**

The present study exposed two female rhesus monkeys to a magnetic field of  $10^{-3}$  T alternating at 10 Hz and 60 Hz. Low intensity electric fields were simultaneously present. The fields did not influence operant response rates, reaction time, matching-to-sample or motor activity. This study,

in addition to two similar studies with male animals, supports the contention that ELF electromagnetic fields of low intensity do not have effects on purposive behavior in rhesus monkeys.

M4305.08-3007DMD0.4  
NAMRL-1167

Bivariate Normal Frequency Distributions Part II: Figures of Percentages By Cells 10/1/72

Margaret J. Smith and William F. Moroney

**Abstract:**

Bivariate normal frequency distributions are often needed by researchers, designers and engineers, but are not readily available in a workable format. The purpose of this report is to present selected bivariate normal frequency distributions in a format which indicates the percent of the population included within a particular cell.

Twenty-five bivariate normal frequency distributions were prepared for specific correlation values from 0.00 to 0.95 in steps of 0.05 and from 0.96 to 1.00 in steps of 0.01.

M4312.01-5001BELJ  
NAMRL-1193

Measurement of Mass Distribution Parameters of Anatomical Segments 10/26/73

Edward B. Becker

**Abstract:**

Procedures to determine the center of mass and the moments of inertia in three dimensions of previously defined anatomical segments are presented. As an illustration, these procedures are applied to the human head and head-and-neck. The results of measurements made on six human heads and three head-and-necks are presented and discussed.

ONR N00014-69-A-0235  
NAMRL-1178  
(AD 776 701)

Structural Considerations of the 3/20/73  
Human Vertebral Column Under  
 $+G_x$  Impact Acceleration



Channing L. Ewing, Albert I. King  
and Priyaranjan Prasad

Abstract:

Among the major limitations on manned aerospace vehicular-and-escape-system designs are the structural limits of the human body. One of the lower limits is the strength of the vertebral body under  $+G_x$  (eyeballs down) impact acceleration. When the vertebral column is considered as a structural member, a finite limit on non fracturing accelerations can be specified, as has previously been the case. An hypothesis as to the mechanism of fracture, which suggests an approach capable of raising the limit, and experimental evidence in support of the hypothesis are presented. A crude device based upon the approach was designed and tested experimentally on cadaveric exposures to  $+G_x$  acceleration. A statistically significant increase in the level of acceleration required to cause fracture was measured.

ONR N00014-71-C-0354  
M4305.08-3011DAB5  
NAMRL-1190  
(AD 766 498)

The Effect of Noise Exposure During 8/31/73  
Primary Flight Training on the  
Conventional and High Frequency  
Hearing of Naval Aviation Officer  
Candidates

Ronald M. Robertson and Carl E. Williams

Abstract:

Conventional audiometry (manual and self-recording), high frequency audiometry (4 kHz to 18 kHz), and a speech intelligibility test in noise were administered to 108 Naval Aviation Officer Candidates prior to and following primary flight training in T-34 aircraft. Cockpit noise levels in the T-34 range from 96-115 dBA; during cruise the level is approximately 100 dBA. Hearing protection

consisted of either the APH-6C or APH-6D flight helmet. Results indicate no significant change in hearing sensitivity or speech discrimination that could be attributed to noise exposure during primary flight training. Further studies should be undertaken to determine whether such effects occur during subsequent phases of training as the subjects are exposed to different aircraft acoustical environments (helicopter, prop, and jet). Pre- and post-primary hearing levels obtained for the high frequencies compare favorably with high frequency hearing levels obtained by Northern *et al.* (1968) for males in the age range 20-29 years.

NASA T-5904B  
NAMRL-1191  
(AD 767 646)

The Value of Exercise at One-Half Earth Gravity in Preventing Adaptation to Simulated Weightlessness 6/25/73

John Roche and Ashton Graybiel

Abstract:

Twelve male subjects participated in two identical experimental series to determine the value of exercising 4 hours daily at one-half Earth gravity (simulated) to prevent loss of exercise capacity and orthostatic tolerance when exposed to 14 days of simulated weightlessness. In one series four subjects exercised at half-gravity (HGE) subjects) on treadmills mounted in a human centrifuge and four exercised on treadmills mounted on inclined planes; in the other series the subjects switched exercise devices. Four subjects served as no-exercise controls throughout both series. Orthostatic tolerance was measured in a lower body negative pressure device and exercise capacity was measured with the aid of a treadmill. Additional measurements

included: plasma volume and red cell mass, urinary sodium and potassium, and peripheral renin activity. The findings revealed no significant differences between the responses elicited during exercise in the centrifuge or on the inclined plane, hence, use of the latter device will greatly increase cost effectiveness in any future experiments. A difference in LEMP tolerance between the two groups was not demonstrated when measurements were made before and at the end of the deconditioning period and after recovery. There was evidence, however, that the time course of 6:00 A.M. peripheral renin activity differed in the two groups. Exercise capacity diminished in both groups, but there was a twofold greater loss in the control compared with the HGE group. Control subjects manifested greater losses of plasma volume but smaller losses of weight than HGE subjects. No significant differences between the two groups were found in the patterns of urinary electrolytes or the loss of red cell mass. The results are discussed not only in terms of the present experiment but also in terms of their significance for long-range plans involving the use of artificial gravity as a countermeasure on space missions.

NASA T-81633  
NASA T-5904B  
NAMRL-1168  
(AD 769 268)

Thresholds for the Perception of 6/11/73  
Angular Acceleration as Indicated  
by the Oculogyral Illusion

E. F. Miller II and Ashton Graybiel

Abstract:

The semicircular canal threshold, as measured by the perception of the oculogyral illusion, was determined by a double staircase procedure among 300 normal and 4 labyrinthine-defective subjects. A motorized chair with precise servo controls rotated the subject in a CW or CCW direction at

rates varying in accordance with one of 24 extended trapezoidal-shaped profiles: 20 sec of constant acceleration, 25 sec at constant (terminal) velocity, 20 sec of constant deceleration and 25 sec at zero velocity. Accelerations ranged in logarithmic progression from  $0.02$  to  $6.00^{\circ}/sec^2$ . The illusion appeared as rightward or leftward movement of the visual target in the direction of acceleration. The target, a narrow collimated line of light, was contained within a goggle device worn by the subject and therefore fixed in relative position to him.

The method provided a brief and reliable ( $\rho=.70$ ) threshold measurement. The majority of normal subjects revealed no substantial directional preponderance (CW vs CCW threshold). Threshold frequency distributions for the two directions of acceleration were similar and ranged in rate ( $deg/sec^2$ ) from 0.20 to 0.950 with means of 0.146 (CW) and 0.152 (CCW), a median of 0.096 (CW, CCW), and modes of 0.096 (CW) and 0.076 (CCW). The threshold of response ( $deg/sec^2$ ) in more than half the normal subjects was less than 0.10, in over three fourths was less than 0.20, in over 90 per cent less than 0.30, and 100 per cent less than 1.00. None of the labyrinthine-defective subjects perceived the illusion at the highest acceleration ( $6.00^{\circ}/sec^2$ ) employed.

NASA T-81633  
NASA T-5904B  
NAMRL-1182  
(AD 772 702)

Perception of Body Position and 6/4/73  
Susceptibility to Motion Sickness  
as Functions of Angle of Tilt and  
Angular Velocity in Off-Vertical  
Rotation

Earl F. Miller II and Ashton Graybiel

**Abstract:**

Four normal subjects manifested little or no susceptibility to motion sickness in a chair device tilted 10° off-vertical and rotated at 2.5 rpm or 5 rpm; with further rate increases the endpoint of mild symptoms was always reached and within increasingly shorter durations. Susceptibility was maximal at either 15 rpm or 20 rpm but with higher rotational rates declined rapidly, reaching a plateau of relatively low susceptibility at 40 rpm and 45 rpm; furthermore, at these higher velocities, the subjects began to lose their sensation of being tilted off-vertical. Two subjects were asymptomatic when the chair was tilted 2.5° off-vertical and rotated at 17.5 rpm; with greater angles of tilt susceptibility of all subjects increased in ever-decreasing amounts.

NASA T-81633  
NASA L-43518  
NAMRL-1156  
(AD 747 627)

Specific Acute Losses of Vestibular Function in Man Following Unilateral Section of One or All Components of the Eighth Cranial Nerve 1/21/72

Earl F. Miller II, Jack L. Pulec,  
James G. Wilcox and Ashton Graybiel

**Abstract:**

Functional tests of the specific auricular organs were administered to four patients who had the common complaint of disabling vertigo and tinnitus. Diagnosis of unilateral inner ear disease or disorder was aided by a relative decrease in right- or left-ear response as recorded by certain techniques, while other methods demonstrated undisturbed function. Partial and complete VIIIth nerve sections completely eliminated the tinnitus and severe symptoms of vertigo in each patient, as well as greatly reduced his extremely high susceptibility to motion sickness, although it caused a short-term increase in instability in walking and standing. Specific auricular organ loss of function was related to the side and extent of the surgical interference. Possible clinical implications are discussed.

DATA W-13, 200  
PAGE 1198  
(AD 773 614)

Unified Range Spectrum and LET  
Distribution for HZE Particles  
of Galactic Radiation in Space 12/14/73

Hermann J. Schaefer

**Abstract:**

A unified range spectrum for the flux densities of HZE particles of galactic radiation in space is presented for establishing the individual spectrum for any Z number with a simple scaling procedure. Data on Z abundances are presented and the Z spectrum from Z = 2 to 28 is divided into four classes. Range spectra for the class representatives are derived. The influence of the geomagnetic cutoff on the range spectra for different latitudes is discussed. The data are summarized in two graphs from which event sizes in terms of LET and related track lengths and their frequencies for given target volumes can be read directly.

Special Reports

NAMRL 73-2  
(AD 764 068)

A Study of the 1970 Adminis- 6/5/73  
trative Reduction of Student  
Naval Aviators

Annette G. Bairden

**Abstract:**

In August, 1970, adjustments in naval aviator manpower requirements led to an unprecedented release of student naval aviators. A representative sample of these student aviators was surveyed for the purpose of assessing attitudes, reactions, and impact upon morale of the forced release. Results indicate considerable disappointment and dissatisfaction as well as a possible unfavorable influence upon recruitment. In comparisons made between reinstated and non-reinstated students no statistically significant differences were found.

NAMRL 73-3  
(AD 767 964)

Animal Disease Survey of Navassa 6/25/73  
Island, West Indies

Richard J. Brown, James L. Kupper, W. C. Hixson, John Bowman, Robert O. Baker, Robert D. Davis, A.F. Horne, and W. E. Britz

**Abstract:**

Navasse Island is located  $18^{\circ} 25'$  minutes north and  $75^{\circ}$  and zero minutes west and is the closest American possession to the United States Naval Station at Guantanamo Bay, Cuba. The island is uninhabited but has potential use to the United States if any sudden change in the Caribbean political situation should occur. Nearly all overseas American possessions have been surveyed for animal diseases with special cognizance toward zoonotic diseases.

The wild animals studied on Navassa Island included goats, rats, and several species of birds. Low levels of mercury and DDT were detected in these animals. Radioiso-

tope analysis of animal tissue revealed low levels of plutonium 238 and 239. Light microscopy examination of tissue demonstrated sarcosporidiosis in wild rats, central nervous system degeneration in the goat compatible with a slow virus disease known as scrapie, avian malaria and several pathogenic metazoan parasites in various vital organs.

A contact dermatitis in man caused by the tree, Metopium toxiferum was identified. Sera from goats, rats, birds and bats were negative for rabies and avian influenza.

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